AMERICAN DENDROBATID GROUP

Newsletter No. 16 July-August 1994

The purpose of the ADG is to develop better communication between Dendrobatid breeders in North America. It is designed, by its format and bi-monthly distribution, to provide current information and new developments in the hobby. We hope that this will aid us in solving some of the problems which confront us all. This newsletter appears bimonthly at a cost $10.00 per calendar year. Back issues for 1992 are available for $5.00; back issues for 1993 are available for $10.00.

Subscriptions, comments, etc. should be sent to Charles Powell (2932 Sunburst Dr., San Jose, CA 95111 Tel.: (408) 363-0926) .

NOTES FROM THE EDITOR

I would like to take this opportunity to encourage everyone to send me a list of species they are keeping so this data can be added to the year end membership list. This is a list of members, their address, and the frogs they keep which is included with the November-December issue of the Newsletter. It is a resource that lets members know whom to contact for information if they get a new species they are unfamiliar with or if they have questions about a certain taxa. Also dues for 1995 can be sent in with the list of taxa your keeping.

The contest for a banner for the ADG Newsletter is still open, so please consider submitting art work today. A winner will be chosen by the end of November and the new banner will appear in the Newsletter starting next year. Also we are in need of slides of frogs to produce a page of color photographs to be included with the November-December issue of the Newsletter. Please submit your slides to the Editor today. Thanks.

SKIN SECRETIONS OF DENDROBATID FROGS

Steve Grenard, R.R.T.

Adapted and excerpted from MEDICAL HERPETOLOGY by Steve Grenard. This book can be ordered from NG Publishing, Inc., RD#3, Rte 61-HWY, Box 3709A, Pottsville, PA 17901. Price: $19.95 + 2.50 P&H.

Frogs and toads possess a wide variety of biochemical substances both within their bodies and freely transmittable to their environment through pore-containing or exocrine glands in their skin. Many of these substances, if they find their way into the body of humans or other species, can result in poisoning — morbidity and, in some cases, mortality. However, unlike snakes, Helodermid lizards and at least one group of squirting salamander, frogs have no way of actively delivering their toxins. Most poisonings are the

result of careless handling by humans or attack by predators who end up ingesting these substances orally. Human poisonings also occur as a result of deliberate or voluntary ingestion in an effort to obtain the medicinal properties of some of these substances, some of which have hallucinogenic side-effects. The Embera Choco and other primitive South American Indian tribes tip their hunting darts with these substances. In the past arrows and darts laced with frog poisons may have been used in warfare although no current use of arrows tipped with these venoms has been documented.

On the basis of LD50 studies in laboratory mice, the dendrobatid frogs contain, on a drop for drop basis, some of the most poisonous substances known on Earth. More than 200 different alkaloids have been identified in these frogs. In studies involving isolated guinea pig atria, these toxins demonstrated both positive chrontrophic (heart-rate affecting) and inotrophic (heart contractile force affecting) properties that result in cardiac arrhthymias rapidly followed by cardiac arrest. The LD50 in mice for the average batrachotoxin is 2 micrograms per kilogram. Compare this with 500 micrograms per kilogram for curare. The dendrobatid *Phyllobates terribilis* is alleged to be one of the most poisonous animals on earth. An adult frog can contain nearly 2 milligrams of batrachotoxin, an amount capable of killing 10 adult male humans.

Batrachotoxins work by depolarizing electrical membranes through increasing their permeability to sodium ions. At high concentrations fast axonal transport blocking has been documented, an event which results in total paralysis. Compared to tetrodotoxin (Puffer or "fugu" fish toxin) which is a sodium channel blocker, batrachotoxin works by activating the sodium channel in an "open-mode." This toxin can therefore produce swelling of the axon due to extracellular water accumulation. No severely or moribund human dart poison frog victim has ever reached medical care prior to death; therefore no treatment plan has ever been explored in dealing with this disorder. Nothing is known of the incidence of accidental poisonings of Indians who routinely use these substances to hunt nor is it known if these peoples have antidotes available in the event of mishap. Symptoms observed in poisoned animals including those receiving sub-lethal doses (from which they recovered) included strong muscle contractions, seizures, paralysis, excessive salivation, gagging or choking and labored breathing. Traces of toxins from *Phyllobates terribilis*, if touched, caused burning sensations as they evidently are able to penetrate hair follicles or other pores in the skin. Scientists who have "taste-tested" the dorsum of *Phyllobates vittatus* reported a numbness of the tongue followed by a disagreeable tightening feeling in the throat.

While it is evident that becoming envenomated by these toxins through introduction into the blood stream or lymphatic circulation is the most dangerously lethal method, Myers reported that a local dog and a domestic chicken died simply by ingesting the discarded carcasses of *Phyllobates terribilis* while foraging through the trash of Myers' research encampment in western Colombia. The fact that dendrobatid poisons can be lethal if ingested creates a mystery insofar as the safe consumption of game killed by these poisons is concerned. It is likely that one of at least three things happen to make such game safe to consume; foreign toxic substances are apt to concentrate in visceral organs such as the liver and kidneys which are discarded prior to cooking; prolonged cooking over high heat may

attenuate or destroy such toxins and/or the toxins are rapidly metabolized and converted to innocuous metabolites. All three possibilities may occur, combining to completely attenuate the poisons prior to eating the game killed by these substances.

The small size and colorful patterns on some dendrobatids have made them into popular terrarium specimens and they are both being collected in the wild and bred in captivity to serve this rapidly expanding hobby. In spite of their secretions the author was unable to find a single instance of any terrarium fancier with these animals who became ill as a result of inadvertent contact with their toxins. As a result of observations in captives it has also been learned that many of these species do not completely preserve all of their toxic potential when kept as long-term captives or when born into captivity. This leads one to conclude that a good part of their toxicity in nature is due to conditions in their wild diet which is not the precisely the same in captivity. Small insects which serve as food for these animals in the wild feed on plants, a variety of which contain many poisonous alkaloids. Thus miniscule amounts of such alkaloids wind up in the insects. Quantities of such insects are consumed by the frogs and the poisons, which originated in plants fed upon by the insect prey of the frogs, is further concentrated up the food chain reaching enormously toxic levels in the frogs. Thus feeding captive frogs on insects raised on non-toxic foods in all probability halts the continued production of alkaloids in the frogs. A 1992 study by Daly and colleagues reports that toxins from *Dendrobates auratus* found in three different geographic locales differed markedly from each other. They studied the introduction of this species (from Isla Taboga, Panama) into the Manoa Valley, Hawaii in 1932. They found that although pumiliotoxin-A and a decahydroquinolone were still major constituents in the skin extracts of the Hawaiian frogs descended from the 1932 founding population, histrionicotoxins were absent; however, a totally new and unexpected tricyclic alkaloid was discovered. Offspring of wild-caught parents from Hawaii, Panama and Costa Rica, raised in indoor terraria on a diet of cricket pinheads and fruit flies DID NOT contain detectable levels of skin alkaloids. Offspring raised in large outdoor terraria in Hawaii and fed mainly wild-caught termites and fruit flies contained the same alkaloid profile as their wild-caught parents. The authors conclude by saying that the genetic, environmental and dietary determinants of alkaloid profiles in dendrobatid frogs remains obscure;" ....in particular the underlying cause for total absence in terrarium-raised frogs." While this statement is certainly reassuring to hobbyists involved with these frogs, it is still wise not to handle specimens with bare hands (use nets or large bore capped plastic tubes) and to guard against their escape. Handling captive dendrobatids carelessly is probably more harmful to the frogs than it is to the handler.

The thesis that diet is at the root of these frog's toxicities is amplified by much anecdotal observation. Frogs residing in areas of cocaine (cocoa) propagation excrete alkaloids many more times as toxic as pure cocaine itself. These frogs eat insects which feed on the cocoa plant leaves. Recently Daly has isolated a new substance, epibatidine, from *Epipedobates tricolor*, an Ecuadorian dendrobatid. This substance is being explored as a non-addicting, non-sedating pain-killer many times more potent than morphine. Since it cannot be reversed by naloxone, a standard opiate anatgaonist, researchers believe that have a new pain killer that uses receptors that have not yet been identified. It is likely that this

substance owes its origins to insects that feed on an unknown plant containing this substance or its precursors. Herbal painkillers unknown to medical science are common in numerous plants and may or may not be known to Indians living in regions where these medicinals grow. By definition alkaloids are sourced from plants. Their existence in animals is an aberration by comparison. Epibatidine, however, is not an alkaloid but a polypeptide; it is a first among this group of proteins as it contains a nitrogen bridged six-member carbon ring and a chlorine bearing pyridine ring. Chloropyridines are extremely rare among animals as well as plants. It is likely, however, that it owes at least a part of its synthesis in frogs to a plant which served as food for the insects preyed upon by the frog.

The continued study of amphibians and reptiles and the biochemical substances they offer forth promises to engender new pharmaceuticals used to treat a wide variety of medical problems in humans and other animals. The destruction of habitat and the extinction of species needing such habitat can effectively preclude discoveries now just being theorized.

NEW LITERATURE

Grenard, Steve, 1994, Medical Herpetology. Amphibians and reptiles - their influence on, and relationship to, human medicine. NG Publishing, Inc., (Pottsville, PA): 139 pp.

Heselhaus, Ralf and Verfasser, Bildern, 1984, Zur Pflege von Pfeilgiftfröschen (Dendrobatidae). Grundlagen der Haltung und Zucht, Teil 1. Die Aquarien und Terrarien Zeitschrift, 38: 432-433.

Heselhaus, Ralf, 1985, Zur Pflege von Pfeilgiftfröschen (Dendrobatidae). Grundlagen der Haltung und Zucht, Teil 2. Die Aquarien und Terrarien Zeitschrift, 38: 470-471.

Meede, Ute, 1980, *Phyllobates trivittatus*, ein Färberfrosch mit vielfältiger Zeichnung. Die Aquarien und Terrarien Zeitschrift, 33(4): 140-141.

Reubold, Erich, 1980, Nachzucht von *Dendrobates typographicus*, kein Problem! Die Aquarien und Terrarien Zeitschrift, 33(9); 318-319.

Schmidt, Matthias, 1983, Nach wie vor attraktia - *Phyllobates vittatus*. Die Aquarien und Terrarien Zeitschrift, 36(11): 434-435.

Walls, Jerry G., 1994, Keeping poison frogs. T.F.H. Publications (Neptune City, NJ): 63 p.

Zimmermann, Helmut, 1978, Verhaltensbeobachtungen an Färberfröschen. Aquarien Magazine, 12(9): 458-463.

ADDS: For Sale

Dendrobates auratus 'Hawaii'	$25 ea.	Eric Anderson
Dendrobates leucomelas 'Orange'	$60 ea .	12231 Newberry Rd.
Dendrobates tinctorius 'Cobalt'	$40 ea.	Gainesville, FL 32607
Dendrobates tinctorius 'Brazil' (lots of yellow)	$60 ea.	
Epipedobates tricolor (3 morphs)	$30 to $50 ea.	

Dendrobates tricolor (brick red with light blue stripes)	$40 ea.	Patrick Nabors St. Louis Lizard Co. 9849 Manchester St. Louis, MO 63119 (800) 962-7280
Epipedobates trivittatus after August 10th	$75 ea.	Lex Thomas (904) 375-5689

Reptile Specialities (John Uhern, 10051 Commerce, Tujunga, CA 91042 Tel. (818) 352-1796; Fax (818) 353-7381) have various captive breed Dendrobatids imported from Germany for sale. Write or call for information.

The Serpent's Egg (1809 Irving St., NW, Washington, D. C. 20010 Tel.: (202) 462-9443) has various wild caught and captive breed frogs for sale. Write or call for information.

Wanted:

Dendrobates leucomelas - male	Brice Noonan 2580 53rd Terrace SW Naples, FL 33999 (813) 455 5385
Dendrobates azureus - female	Charles L. Powell, II 2932 Sunburst Dr. San Jose, CA 95111 (408) 363-0926

NEW MEMBERS

Rick Barnett (Georgia)
John Boylan (California)
Erik Holtzapple (South Carolina)
Thomas Horn (Pennsylvania)
Erick Kauschen (California)
Jim Larson (Getting Wet! Aquaculture, California)
William Mertz (Arizona)
Scott Robinson (California)
Alexis Thomas (Florida)